A Much-Hyped COVID-19 Drug Is Almost Identical to a Black-Market Cat Cure

Cat owners are resorting to China's underground marketplace to buy antivirals for a feline coronavirus.

Sarah Zhang
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When Robin Kintz's two kittens, Fiona and Henry, contracted a fatal cat disease last year, she began hearing of a black-market drug from China. The use of the drug, known as GS-441524, is based on legitimate research from UC Davis, but the ways to get it seemed much less so. "It was, 'If you want to save your cat, send me thousands of dollars, and I'll DHL you some unmarked vials,'" she says. And she did. Kintz transferred the thousands of dollars, got the unmarked vials from China, and then injected the clear liquid into her dying cats every day for months.

The first remarkable thing, given the nature of the transaction, is that Kintz says the vials actually worked. Henry lived for almost another year, and Fiona made a full recovery. She's still scampering around today, fluffy and alive—a miracle considering that vets had long thought her disease, feline infectious peritonitis, to be incurable and 100 percent fatal. Kintz now runs a 22,000-member Facebook group that helps cat owners using GS-441524. Thousands of cats have reportedly been cured of FIP.

The second remarkable thing is that GS-441524 is almost identical to a much buzzed-about human drug: remdesivir, the antiviral currently our best hope for treating COVID-19, the disease caused by the novel coronavirus. Although early data suggest that the drug shortens recovery time at best, Anthony Fauci has touted remdesivir from the White House. The Food and Drug Administration has authorized it for emergency use. And Gilead Sciences, the company that makes remdesivir, is donating 1.5 million doses of the drug amidst the pandemic.

Henry (L) and Fiona (R) were both treated with GS-441524. Henry died earlier this year, but Fiona is still alive, which her owner Robin Kintz attributes to the drug. (Courtesy of Robin Kintz)

Gilead invented and patented GS-441524, too. Its scientists co-authored the UC Davis studies showing effectiveness against FIP. But the company has refused to license GS-441524 for animal use, out of fear that its similarity to remdesivir could interfere with the human drug's FDA-approval process—originally for Ebola. When that failed, and a global pandemic of a novel coronavirus later arose, the company began testing it against COVID-19. Remdesivir has a small but clever modification that makes it better at entering cells, but it and GS-441524 work in exactly the same way to inhibit viruses.

FIP is also caused by a coronavirus—not the same one that causes COVID-19, but one that specializes in infecting cats. (Although humans may be able to pass COVID-19 to cats in rare cases, humans cannot get FIP from cats.) In most cats, this feline coronavirus, or FCoV, causes mild diarrhea or no symptoms at all. But in a small minority of cases, the virus infects white blood cells, and the immune system goes haywire into full-blown FIP. The disease comes in two forms, both fatal: wet, in which the cat's chest or belly swells with fluid, or dry, in which there is no fluid but the cat is still feverish and sick. Eventually, it dies. For decades, vets have had little to offer but euthanasia.

Then GS-441524 came along. Small trials at UC Davis published in 2018 and 2019 suggested that cats were not just having their life prolonged by days or weeks, but were seemingly cured. “It really was a game changer,” says Drew Weigner, a veterinarian and the president of the Winn Feline Foundation, which funded some of the UC Davis research. “Three years ago, we told patients, ‘Your cat is going to die.’ Now we can tell them something else. It’s quite a story.”

The story of a drug first tested against Ebola (that failed), whose close cousin became a groundbreaking treatment for a cat disease (but only illegally), and that has been resurrected in the pandemic of an entirely new virus underscores the vagaries of drug development. To be clear, while remdesivir is in clinical trials, GS-441524 has not been tested in humans for safety or efficacy against COVID-19. The black-market formulations of GS-441524 are also incredibly expensive. A 12-week regimen for cats can cost upwards of $10,000, depending on the brand, type of FIP, and weight of the cat. Plus, there is no legal way to buy GS-441524 as medicine—not for cats, not for humans.

The drug probably would have never been tested in cats, if not for the fact that Niels Pedersen, a longtime FIP researcher at UC Davis, personally knew the former chief scientific officer of Gilead. The two met 30 years ago, when Gilead was testing antiviral HIV drugs in monkeys and Pedersen was working at a primate research center. But Pedersen’s true love has always been cats. He grew up surrounded by them on a poultry farm. A colleague of his warned me, lovingly, that Pedersen was “irascible,” and he was difficult to get on the phone. But his voice softened when he talked about taming those barn cats and finding homes for their kittens.

Pedersen became fascinated with FIP in vet school in the 1960s, when it was still a mysterious disease with a mysterious cause. Over the decades, scientists would discover the feline coronavirus behind FIP and then spend years trying but failing to develop a working vaccine. Pedersen ended up devoting his career to the disease. And when the vaccines failed, he began thinking about antivirals, and he began thinking, again, of Gilead. The California-based company specializes in developing antivirals, including Tamiflu, Truvada, and a host of HIV and hepatitis C drugs.

Around five years ago, Pedersen got in touch with his Gilead contact, and the company sent him 25 or 30 molecules, drawn from the large library of drug candidates that pharmaceutical companies typically maintain. Two of the molecules worked marvelously in cat cells infected with the FIP virus: GS-441524 and GS-5734, the latter of which is now better known as

Both GS-441524 and remdesivir work by blocking viral replication. They are nucleoside analogues, meaning they mimic the nucleoside building blocks—A, U, C, or G—that make up the virus’s genetic material. Specifically, they mimic “A,” and when the virus is tricked into incorporating a GS-441524 or remdesivir molecule instead of “A”, the replication process gets jammed up. Eventually, no more letters can be added, and the virus cannot replicate. Where the two drugs differ is that remdesivir has an extra phosphate group, a small change that helps it enter a cell and get used in replication. This modification is commonly used to enhance the effectiveness of similar antivirals. “It’s just one of those really clever things that worked

perfectly," says Katherine Seley-Radtke, an antiviral researcher at the University of Maryland, Baltimore County.

For whatever reason, though, this modification did not make much difference in cat cells infected with the FIP virus. Both molecules were effective, so Pedersen decided to pursue the simpler one, GS-441524. He then infected 10 cats with FIP and dosed them with GS-441524. All 10 cats recovered.

"We almost fell out of our chairs," says Weigner.*This is ridiculous*, he remembers thinking. *This can't work this well. Wait, wait, stop, go back? It did what?* The initial study was small and under artificial conditions, but in a follow-up field trial of 31 pets with naturally acquired FIP, 25 ultimately made it—an unheard-of recovery rate. Pedersen had previously tested another antiviral out of Kansas State University, but only seven out of 20 cats had gone into remission. Those results seemed impressive at the time, but GS-441524 appeared to be even better.

Pedersen is 76 now, and he has devoted 50 years of his career to FIP research. Finally, it seemed, a cure was at hand. "I felt really good," he told me, "and I thought this was a good capstone for my career." But the capstone never materialized, at least not in the way that he expected. Despite the success, Gilead refused to license GS-441524 for use in cats.

While Pedersen was testing GS-441524 in cats, a different virus—a human virus—was raging halfway around the world in West Africa: Ebola. The virus that causes Ebola is not a coronavirus, but remdesivir is unusually broad-acting for an antiviral, and early results against Ebola were promising. So promising, in fact, that the company was eyeing FDA approval of remdesivir in humans.

According to Pedersen, Gilead worried that the cat research could impede the approval process for remdesivir. Because GS-441524 and remdesivir are so similar, any adverse effects uncovered in cats might have to be reported and investigated to guarantee remdesivir's safety in humans. Gilead's caution about generating unnecessary cat data is standard industry practice. "One of the rules in drug development is never perform a test you don't have to, if the results could be problematic," says Richard Sachleben, a retired pharma-industry researcher. (Gilead declined to comment for this story.)

For Pedersen, the explanation was hard to accept. "It was a blow," he said. "It hits you very hard, especially when you didn't see any reason for it." He still published the studies, as academic researchers do, and results became public in 2018 and 2019.

Not long after, Pedersen began hearing from people in China. One company wanted to license the drug from Gilead, he told me, and it asked Pedersen to be the intermediary. The company failed to get a license but started selling an FIP drug anyway, and its exact formula is unclear. Other companies explicitly advertise their formulations as GS-441524. China has a large base of pharmaceutical manufacturing, and raw GS-441524 is not particularly difficult to synthesize. FIP is also a growing problem in the country as cats—especially purebred cats, which are more prone

to the disease—become more popular in China. A black market has sprung up to fill the vacuum left by Gilead.

The use of drugs from China was at first controversial in the FIP community. “I got a lot of hate mail for it. I lost a lot of supporters,” says Peter Cohen, an early supporter of the drugs. Cohen runs ZenByCat, a nonprofit that raises money for two groups funding FIP research, SOCK FIP and the Winn Feline Foundation’s Bria Fund for FIP Research. Earlier iterations of Facebook support groups, such as FIP Fighters, initially banned any discussion of the black-market drugs too.

Susan Gingrich, a former administrator of that Facebook group, has focused on pressuring Gilead. Gingrich, whose brother is former House Speaker Newt Gingrich, is also the founder of the Bria Fund. Her cat Bria died of FIP in 2005, and she established the fund with donations from her brother and herself and her husband that same year. “It would be so much easier if Gilead would have either marketed it or let another entity market it,” she says. Gingrich bought stock in Gilead after early research into GS-441524 seemed promising. In June 2019, she wrote a letter to Gilead, as well as to President Donald Trump and her congressman and senators in Tennessee, imploring the company to allow animal use of the drug. She says she’s received no response.

When Kintz was trying to save Fiona and Henry, she asked about GS-441524 in one of those Facebook groups that had banned discussion of the drug. Her post in the group went nowhere, but two women privately messaged her with advice. Kintz ended up starting a new group, now called FIP Warriors, so they could exchange tips and feedback on different brands. The group grown to 22,000 members on Facebook—as well as 25 admins and 26 moderators. It has satellite groups in different countries and languages around the world. “It feels like a global corporation sometimes,” says Kintz, who is a design consultant in upstate New York when she’s not running the Facebook group. If she is going to be offline for, say, six hours, she notifies her fellow admins and moderators. The Facebook group has morphed into a 24/7 international organization.

FIP Warriors also has a network of emergency group chats for every state. Because shipping from China can take a long time and because the earlier that GS-441524 treatment is started, the better, the emergency chats connect new members with those who have vials of extra GS-441524.

Zina Lemesh, a lawyer and cat breeder in New York, joined the group in February, when her cat Nora grew jaundiced and stopped eating, and her belly swelled up like a bowling ball. Lemesh recognized the signs of wet FIP, and she knew it as a hopeless disease. She was preparing to call her vet about euthansia when she came across the group in a frantic online search for a treatment. She posted an emergency plea for GS-441524. “Within 10 minutes, I was in contact with someone,” she told me. “Within the next two hours, my cat already had shots.” And within a couple days, Nora started eating again. She is almost done with her 84-day regimen. Her swollen belly is completely gone.

“This is a cat mom and an attorney speaking at the same time and I try to balance the two in my brain, which it’s hard,” Lemesh said. On one side is the cat mom who would go to great lengths

to save her cat; on the other is the rules-minded lawyer who can't believe she injected her cat with unlabeled drugs from a stranger. But if it's between letting Nora die and a small chance at saving her, the choice was clear. Of course, Lemesh told me, she would rather go the legitimate route—if that were an option. "Do you think people would like to send $7,000 to $12,000 to some weird source?" she said. "Or would they prefer to pay their vet?"

The black-market availability of GS-441524 puts veterinarians in a bind. They can't prescribe the drug or legally buy it for cat owners. Some do agree to help owners with the injections, which can be difficult and painful for the cat. But others want nothing to do with the unapproved drug. Linda Pendergrass-Nethery, who lives in Chattanooga, Tennessee, told me she ended up switching vets. Her first vet refused to help, she said. The second prescribed the sedative gabapentin to mellow out her cat, Sundance, for injections. So every afternoon, a couple hours before Sundance's daily injection, Pendergrass-Nethery and her husband give him a dose of gabapentin. When the time comes, they burrito him up into a white towel—"like a mummy," she said—and inject him with GS-441524. It's definitely a two-person job.

In the meantime, FIP Warriors has grown prominent enough that Chinese sellers are now approaching the group to market their GS-441524. They seem to pop up and then disappear. "It's hard to say if they're companies or sort of backdoor dealers," Kintz says. But the group has tried to institute a small measure of accountability. It had, at one point, tested a few popular brands to verify the concentration and content of their GS-441524 vials. When new sellers approach, the group asks for samples to send to cat rescues, which might not be able to afford GS-441524 for kittens that would otherwise certainly die of FIP. "That's generally how we determine if it works and if it's going to be okay," Kintz says. But the group is also rife with disclaimers about not being able to verify any particular drug.

Case in point: This January, a popular brand of GS-441524 appeared to kill cats that had been given the drug. When the group started noticing a pattern, admins began collecting data and warning against the brand's most recent batch. The man who had been selling it online disappeared, with several members of the group posting that he still owes them money. Rumor was that he and his wife had divorced acrimoniously; she had been the brains behind the operation, and he had tried and failed to continue the business. Then a new brand of GS-441524 popped up—reportedly made by his wife. It's all impossible to verify half a globe away. "It's truly like the Wild West," Kintz says.

The recent surge of interest in remdesivir could change some of this dynamic. After Ebola trials found little benefit, remdesivir became a drug in search of a (human) disease. Should remdesivir ever be granted proper FDA approval beyond emergency use for COVID-19, and if it becomes common enough to prescribe through pharmacies, then vets could legally use it extra-label in cats. "It may be five years down the road, and COVID is a distant memory, and then it is used for FIP," Weigner says. For now, at least, the cat-specific data on remdesivir is still lacking.

Kintz hopes that GS-441524 can, one day, be legally available for cats. Then, she says, "no one would need me anymore, but that's okay."